REMARKS

By the present amendment, claims 12-20 are pending in the application.

Support For Claims

Claim 12

New independent claim 12 is a combination of original independent claim 1 and original dependent claim 2 written in response to the rejection under 35 U.S.C. §112, second paragraph, taking into account the comments made in the Office Action. Lines 11-17 of prior independent claim 1 have been rewritten to make clear the structural limitations claimed. Regarding the claim limitation "with no sintered bridges formed", see, e.g., specification page 10, lines 29-35.

Claim 13

New dependent claim 13 corresponds to original dependent claim 3 written in response to the rejection under 35 U.S.C. §112, second paragraph. The variance of the foils defined in independent claim 12 (second foil being a flat foil or a corrugated foil) has been limited to the use of a corrugated foil for the first foil and a flat foil for the second foil. Antecedent basis has been provided for the "entry side" and the "delivery side". The structural limitations of the solder bonds and the diffusion bonds have been more clearly set forth.

Claim 14

New dependent claim 14 corresponds to original dependent claim 4 written in response to the rejection under 35 U.S.C. §112, second paragraph, in order to make the structural limitations clear.

Claim 15

New dependent claim 15 corresponds to original dependent claim 5 written in response to the rejection under 35 U.S.C. §112, second paragraph, in order to make the structural limitations clear.

Claim 16

New independent claim 16 corresponds to original independent claim 6 written in response to the rejection under 35 U.S.C. §112, second paragraph. The term "b" is defined in claim 16 as the contact area. The term "strip" has been deleted. The phase "in the case of winding" has been deleted. Ra in claim 16 (and prior claim 6) is surface roughness before diffusion bonding as defined in claim 16. Ra in claim 12 (and prior claim 1) is surface roughness after diffusion bonding as defined in claim 12. Lines 23-25 of original claim 6 have been rewritten to make clear the structural limitations claimed.

Claim 17

New dependent claim 17 corresponds to original dependent claim 7 written in response to the rejection under 35 U.S.C. §112, second paragraph, in order to make the

limitations clear. The specification, e.g., at page 14, lines 22-24 discloses that it is preferred to use Rac.

Claim 18

New dependent claim 18 corresponds to original dependent claims 8 and 9 written in response to the rejection under 35 U.S.C. §112, second paragraph, in order to make the claim limitations clear.

Claims 19-20

New dependent claims 19 and 20 correspond to original dependent claims 10 and 11 written in response to the rejection under 35 U.S.C. §112, second paragraph, in order to improve clarity.

Drawings

The reference numeral "13" was objected to in Figs. 7(a) and 7(b) and Fig. 8 of the drawings.

In response to this objection, replacement sheets for Figs. 7(a) and 7(b) [sheet 6/8] and for Fig. 8 [sheet 7/8] are attached hereto wherein the reference numeral "13" has been deleted.

The drawings were objected to because the reference numeral "6" was used to designate both protrusions 6 (page 15, line 20) and foil 6 (page 1, line 29 and page 15, line 20).

In response to this objection, the specification has been amended at page 15, line 20 to delete use of reference numeral "6" as designating the protrusions.

The drawings were objected to because they included the reference numeral "13" in Figs. 7(a) and 7(b) and Fig. 8 which is not mentioned in the specification.

In response to this objection, replacement sheets for Figs. 7(a) and 7(b) and Fig. 8 are attached hereto wherein reference numeral "13" has been deleted.

Figs. 1, 2 and 5(b) were objected to because they should be designated by the a legend such as --Prior Art--.

In response to this objection, attached hereto are replacement sheets for Fig. 1 and Fig. 2 [sheet 1/8] and Fig. 5(b) [sheet 4/8] wherein Figs. 1, 2 and 5(b) have been designated by the legend --Prior Art--.

In view of the drawing replacement sheets attached hereto and the amendment to the specification at page 15, line 20, it is respectfully requested that the objections to the drawings be withdrawn.

Specification

The Office Action objected to the specification at page 5, line 19 because of reference to Publication No. 9-119915.

By the present amendment, the specification has been amended at page 5, line 19 to replace No. 9-119915 with No. 10-309472. Japanese Unexamined Patent Publication No. 10-309472 discloses the described method and is the publication of Japanese Patent Application No. 9-119915.

The Office Action objected to the specification at page 13, line 11 on the grounds that it was unclear what "b" and "V" stand for.

In response to this objection, the specification has been amended at page 13, line 12 to provide a definition of "b". The definition of "b" is support by the specification, e.g., at page 14, lines 11-12.

The letter "V" does not appear at page 13, line 11 or elsewhere on page 13. The Examiner is respectfully requested to clarify the objection to "V" in the next communication from the Patent and Trademark Office.

If "V" means "λ", the term "λb" is defined by the equation at page 13, line 13.

The Office Action objected to the specification at page 19, because the exhaust gas flowing face 3 is not in Fig. 10.

In response to this objection, the specification has been amended at page 19, line 34 to change "gas flowing face 3" to --gas entry face 3-- to conform the description of the specification to Fig. 10 of the drawings.

As previously discussed, page 15, line 20 of the specification has been amended to conform the description of the specification to the drawings.

In view of the present amendment, it is respectfully requested that the objections to the specification be withdrawn.

Claim Objections

Claims 2 and 3 were objected to as being in improper multiple dependent form.

Applicants maintain that claims 2 and 3 are in proper dependent form.

However, by the present amendment, claims 2 and 3 have been canceled. Therefore, the objection to claims 2 and 3 is now moot.

It is therefore respectfully requested that the objection to claims 2 and 3 be withdrawn.

§112, ¶2

Claims 1-11 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite.

In response to this rejection, claims 1-11 have been canceled by the present amendment and replaced with new claims 12-20.

New claims 12-20 take into account the comments made and issued raised in the Office Action in the rejection under 35 U.S.C. §112, second paragraph.

New claims 12-20 of the present amendment have been previously discussed.

It is believed that new claims 12-20 comply with the requirements of 35 U.S.C. §112, second paragraph.

In view of the present amendment, it is respectfully requested that the rejection under 35 U.S.C.

§112, second paragraph, as applied to new claims 12-20 of the present amendment, be withdrawn.

§102

Claims 1 and 2 were rejected under 35 U.S.C. §102(b) as being anticipated by Japan No. 08-038912.

This rejection, as applied to new claims 12-20, is respectfully traversed.

Allowable Subject Matter

The applicants are pleased to note that the Office Action advised at page 5 that claims 3-5 would be allowable if rewritten to overcome the rejections under 35 U.S.C. §112, second paragraph, and to include all the limitations of the base claim and any intervening claims.

The applicants are pleased to note that the Office Action advised at page 6 that claims 6-11 would be allowable if rewritten or amended to overcome the rejections under 35 U.S.C. §112, second paragraph.

By the present amendment, independent method claim 16 and dependent method claims 17-20 correspond to prior independent method claim 6 and dependent method claims 7-11 rewritten to overcome the rejections under 35 U.S.C. §112, second paragraph.

It is therefore submitted that new independent method claim 16 and dependent method claims 17-20 are patentable.

Patentability

The present invention, as defined in new independent product claim 12, is directed to a diffusion bonded metallic catalyst carrier comprising a honeycomb body composed of a piece of corrugated foil made of heat-resistant stainless steel containing aluminum and a piece of flat foil or corrugated foil made of stainless steel. The piece of corrugated foil and the piece of flat foil or corrugated foil are alternately wound or laminated on each other. The honeycomb body is incorporated into an outer cylinder made of metal. The honeycomb body and the outer cylinder are integrated into one body by means of diffusion bonding.

The pieces of foil have a surface roughness in a width direction of the foil after diffusion bonding wherein an arithmetical mean deviation of asserted profile Ra after diffusion bonding is 0.001 to 2.0 μm.

Diffusion bonds form joint sections between two pieces of foil of the corrugated foil and the flat foil or the corrugated foil with no sintered bridges formed at both end portions of the joint sections in the longitudinal direction of the pieces of foil.

As described above, a characteristic feature of the present invention is to define the surface roughness of the pieces of foil in the foil width direction after diffusion bonding so that the arithmetical mean deviation of the

asserted profile Ra is 0.001 to 2.0 μm for minimizing aluminum vaporization and ensuring mechanical strength of diffusion bonding.

On the other hand, JP-A-8-38912 discloses that flat foil and corrugated foil having an average surface roughness (Ra) of 0.001 to 0.2 μm, and further discloses that an average surface roughness (Ra) of the inner surface of the outer cylinder is 0.001 to 0.2 μm. However, both values of the surface roughness in JP '912 are the values of the surface roughness before the diffusion bonding is carried out. One cannot estimate the actual surface roughness value in JP '912 after diffusion bonding. As described above, there is a big difference between the average surface roughness before diffusion bonding and the average surface roughness after diffusion bonding. The present invention defines the width direction surface roughness as the arithmetical mean deviated of the asserted profile Ra being 0.001 to 2.0 μm after diffusion bonding.

Furthermore, JP '912 only defines the entire surface of the average surface roughness of flat foil and corrugated foil before diffusion bonding. There is no disclosure or suggestion about the surface roughness of the pieces of foil in the foil width direction after diffusion bonding having an arithmetical mean deviation of the asserted profile Ra of 0.001 to 2.0 μm.

In the case where the arithmetical mean deviation of the asserted profile in the width direction is not more than 0.001 μm, a swell is caused in the piece of foil and it becomes difficult for alumina to adhere to the piece of foil. On the other hand, in the case where this arithmetical mean deviation in the width direction is not less than 2.0 μm, the thickness of the wash-coat (Al_2O_3) becomes irregular. There is no teaching about this phenomenon in JP-A-8-38912.

It will now be explained why the surface roughness of the pieces of foil in the foil width direction after diffusion bonding having the arithmetical mean deviation of the asserted profile Ra of 0.001 to 2.0 μm is important in the present invention.

When diffusion bonding is applied to a metallic catalyst carrier comprising a honeycomb body composed of corrugated foil and flat foil, a diffusion bonding phenomenon between corrugated foil and flat foil is as follows. Attached Fig. A shows this phenomenon.

1) Spot-like diffusion bonded portions are generated at contact portions between corrugated foil and flat foil as shown in attached Fig. A (1).

2) These spot-like diffusion bonded portions are grown in a longitudinal direction (L-direction) of the corrugated foil and flat foil and form islands as shown in attached Fig. A (2).

3) Then these islands are grown in a direction (C-direction) perpendicular to the longitudinal direction and

each island is fused to form a strip-like diffusion bonded portion as shown in attached Fig. A (3).

At this stage, these diffusion bonded portions have sufficient strength as the honeycomb body.

As described above, the most important feature of the present invention is to provide the surface roughness of the pieces of foil in the foil width direction after diffusion bonding having an arithmetical mean deviation of the asserted profile Ra of 0.001 to 2.0 μm.

Further, another important feature of the present invention is that there are no sintered bridges formed at both end portions of the joint sections of the two pieces of foil, the flat foil and the corrugated foil in the longitudinal direction of the pieces of foils for prolonging joint life even if the joint is exposed to high temperature and continual vibration.

Enclosed are two technical publications, Science and Technology of Welding and Joining, 1999, Vol. 4 No. 2 pp 118-124 (first publication), and Vol. 4 No. 3 pp 125-132 (second publication) which are written by Y. Tahahashi who is one of the inventors of the present invention. The first publication describes that the critical temperature depends on the surface roughness of the foil, which can be explained in terms of aluminum evaporation behavior between foils which protect the bonding surface from the residual oxygen gas. The second publication describes that the y direction bond growth process is much more important than the x direction

neck growth sintering process in producing the honeycomb interconnection (see page 130).

As discussed above, JP-A-8-38912 does not disclose or suggest the characteristic features of the present invention in the points of:

1) providing the surface roughness of the pieces of foil in the foil width direction after diffusion bonding having an arithmetical mean deviation of an asserted profile Ra of 0.001 to 2.0 μm, and

2) no sintered bridges are formed at both end portions of the joint sections of the two pieces of foil, in the longitudinal direction of the pieces of foils.

It is therefore submitted that new independent product claim 12, and dependent product claims 13-15, are patentable over Japan No. 08-038912.

There have been no prior art rejections of the method claims. As previously stated, it is submitted that independent method claim 16, and dependent method claims 17-20, are patentable.

CONCLUSION

It is submitted that in view of the present amendment and foregoing remarks, the application is now in condition for allowance. It is therefore respectfully requested that the application, as amended, be allowed and passed for issue.

Respectfully submitted,

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